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EVOLUTION WITHOUT SELECTION.

Die Farbenevolution bei den Pieriden. Von M. C. Piepers. "Tijdschrift der Nederlandsche Dierkundige Vereeniging; 2. Deel v." Pp. 70-289. (Leiden, 1898.)

THE fact is becoming more and more widely recognised that the colours of animals, and especially of insects, afford excellent material for the investigation of dark places in the theory of evolution. As was long ago pointed out by Bates, and reiterated with increased emphasis by Wallace, the history of the modification of species is displayed to view on the wings of butterflies in a manner that is peculiarly legible and strikingly complete. There is, therefore, every justification for those students of evolution who, like Weismann, Eimer, Meldola, Poulton, Bateson, and several others, have devoted much attention to the colour patterns of lepidopterous insects, and have endeavoured with more or less success to use the facts made available by such detailed examination in the elucidation of the laws which govern the origin and development of species.

The pamphlet named at the head of this article is the work of an author whose credentials entitle him at least to an attentive hearing. He has resided for nearly thirty years in the Malay Archipelago—chiefly in the island of Java; during the whole of which time, as he tells us, he has studied the entomology of that region, and has in particular continued to search for explanations of the various phenomena presented by the colours of its lepidopterous fauna. It might be expected, then, that he would be able to bring forward a mass of valuable material derived from such observations and experiments as can best be carried out amid the natural surroundings of tropical species, and would thus be in a position to afford real help towards the solution of questions like those of the value in the struggle for existence of mimetic or of warning colours, the importance of sexual selection and the protective significance of seasonal modifications. So far from this being the case, however, it must unfortunately be stated that he has done little or nothing to increase our knowledge in any of these or similar directions.

The cause of his failure is not far to seek. Being, as he informs his readers, in most respects a follower of Eimer, though disagreeing with his master on certain points of detail, he looks for an explanation of organic evolution in the direction of "laws of growth," uncontrolled by any process of selection, but working out the transformation of species under the influence of external conditions which act upon organisms of varying degrees of susceptibility. The essence of his contention is the non-recognition of selection in any form as a factor in evolution, and he is apparently so sure of his position on *à priori* grounds, that he has not thought it worth while to keep the selection hypothesis in view even as a provisional basis for observation and experiment. This, the *πρωτον ψεύδος* of his position, has had a most disastrous effect upon his work, both as an observer and as a reasoner. It cannot be said that he has any new arguments of weight to bring forward; the main part of

his treatise is taken up with a laborious attempt to show that the course of colour-evolution in the Pierids (or "white" butterflies) has followed, and is following, a definite succession of stages, which continually occur in the same order. Starting from an original red, the process of colour-change in the Pierids, according to Piepers, is always tending to reach a final stage of white, which may be attained either by means of a gradual paling through orange and yellow, or through an intermediate condition of black. This inevitable tendency, arising from an internal impulse towards change in a definite direction, taken in conjunction with external influences which act chiefly by way of accelerating or retarding the process of change, and in relation with individual differences of susceptibility to stimulus, he believes to have been sufficient for the production of the assemblage of diverse forms which constitute the Pierid sub-family as at present existing.

It is no doubt true that, speaking generally, there has been a fairly uniform tendency throughout this group of butterflies towards the replacement of an original dark by a white pigment. But this was not reserved for Piepers to discover, inasmuch as the view in question has been long ago advanced and supported by much more detailed evidence than that brought forward in the present treatise. Moreover, cases have been pointed out where, in consequence of mimetic adaptation or from other causes, the more usual process of change has been reversed or modified—a fact not noticed by Piepers, and not very favourable to his general view. But acquaintance with the work of his predecessors scarcely appears to be a strong point with the author, who frequently either ignores altogether, or dismisses in a curt sentence or two, results of other observers which certainly demand and deserve a careful comparison with his own. The part of his theory for which he really is entitled to claim originality, viz. that the primitive colour of Pierids was a uniform shade of red, seems to rest on extremely slender evidence. To any one who will take a comprehensive view of the whole sub-family, the conclusion from which Piepers does not shrink, viz. that the male of *Appias* (*Tachyris*) *zarinda* most nearly represents in coloration the earliest form of Pierid, will appear to savour of the *reductio ad absurdum*. Without going into the kind of detail which would here be out of place, we may safely assert that there is abundant evidence in favour of the contrary view; and that in many cases, at all events, as in the genera *Mylothris* and *Dismorphia*, there is every reason to attribute the presence of much of the red or orange coloration rather to increased specialisation for a distinct purpose, viz. that of mimicry, than to reversion or survival. Hopkins's researches on Pierine pigments are not unknown to Piepers, but the latter, perhaps wisely, refrains from attempting to reconcile them with his own conclusions.

This brings us to what appears to us to be a serious offence on the part of the author against good taste and good manners in scientific controversy. Nothing but gratitude is due to him for the facts that he has recorded from his own experience; most readers, indeed, will only wish that he had given us more of them. Nor can any one fairly complain of his absolute denial of the modifying influence of selection, even though he thereby puts him-

self in opposition to Darwin, Wallace, Fritz Müller, Weismann, and most of those whose labours have contributed to the establishment of the theory of evolution. But in speaking of views which he does not himself hold, he repeatedly allows himself to use language which is highly unbecoming in a scientific man. This is especially noticeable in his remarks on the subject of mimicry. We are of course prepared to find that he does not believe in it, but it might be thought that a view which commended itself to Bates, Wallace, F. Müller, and Trimen, to say nothing of Darwin himself, was at least deserving of respectful treatment. M. Piepers does not think so, and his language on the subject is so uncontrolled as to suggest doubts whether, in spite of his training as a jurist, he can be considered a fair and competent examiner of evidence. It is easy enough to throw about words like "Aberglaube" and "Humbuglehre" in reference to the views of other workers, and to suggest that opponents are "mentally abnormal"; but such expressions recall the methods of the advocate rather than of the judge, and they render their employer liable to severe retaliation, did any one care to administer it.

A conspicuous instance of this want of restraint occurs in the note on p. 279; where the author altogether overreaches himself in his denunciation of Schröder. It is not our business to correct his literary blunders, but we cannot help thinking that the original utterer of the famous line "*homo sum; humani nil a me alienum puto*" (misquoted, by the way) would be somewhat surprised to see himself referred to as "the old philosopher." This, however, may pass; more open to question is the wisdom of introducing the quotation at all. M. Piepers seems to think that the upholders of mimicry will be "angry" at his strictures. They are more likely to be amused, and perhaps a little saddened, for there is always an element of pathos in resistance to the inevitable.

Protective resemblance, in relation to selection, fares no better with the author than mimicry itself. Thayer's demonstration of the protective value of the pale underside of birds and mammals is convincing enough for most minds; Piepers simply dismisses it with the remark that he cannot admit it in the case of insects. One is tempted to ask him what he expected in the case of insects, but this dictum is a not unfair specimen of his critical method generally. It is difficult to answer a disputant who holds (p. 250) that the resemblance to forms of vegetation shown by the underside of *Euchloe cardamines* and even of *Kallima paralecta* is accidental. The somewhat unseemly comparison on the same page is perhaps meant for a joke. If so, it says very little for the author's humour; if not, it says even less for his logic.

The treatment of seasonal forms affords another instance of his curious reluctance to accept the plain and obvious explanation of certain facts, if that explanation involves a recognition of the principle of selection. Some of his remarks on the varying forms of Malayan butterflies have all the interest and importance which naturally belong to the personal observations of a good field naturalist, but it is strange to find him still advancing theories of the direct influence of local conditions which were long ago discarded by Wallace. The truth which underlies his statements is probably this—that polymorphism gives an opportunity to selection, under

which influence it may become limited by locality and season. In his discussion of the permanent or variable whiteness of certain animals, he cannot of course shut his eyes to the fact that the same visual effect of whiteness is produced in different cases by different means. He remarks in a somewhat puzzled way that there is nevertheless evidently some connection between the whiteness caused by a white pigment (so-called) and that due to scattered reflection. Of course there is, or may be, such a connection; but the obvious key to the mystery, viz. selective adaptation, is not even noticed by him.

It is really pitiful to witness the straits to which those evolutionists are reduced who desert the firm and clear lines laid down by Darwin. Towards the end of his treatise M. Piepers makes a certain appeal for the indulgence due to an amateur. We are inclined to admit his claim, and to judge him leniently on that account. Courage and candour he does not lack, and it is deplorable that having tasted the "Pierian spring," he has not taken a deeper draught of its waters. A little more reading would have shown him that many of his discoveries had been already made, and that most of his difficulties had been answered by anticipation.

F. A. D.

PROFESSOR TAIT'S COLLECTED PAPERS. Scientific Papers. By Peter Guthrie Tait, M.A., Sec.R.S.E., &c. Vol. i. Pp. xiv + 498. (Cambridge University Press, 1898.)

THE Cambridge Press has already laid mathematical and physical workers under deep obligations by its editions of Maxwell, Stokes, Thomson, and Cayley. It now proposes considerably to extend these obligations, and as an instalment of their fresh enterprises we have here the first volume of the collected papers of Prof. Tait. This reprint appeals to readers of widely different interests, and will be welcomed by all, not only on account of the highly specialised investigations of various kinds which it contains, but also as a monument to a writer to whom science owes a great deal.

It would be out of place, even if the reviewer were competent, to attempt any detailed examination of the papers here presented. They have been before the world for many years, and their value and originality have not been contested. A rapid sketch of the contents may, however, be given. A large proportion of the book is taken up with the quaternion investigations in which Prof. Tait first made his mark, and to which he has returned from time to time with undiminished enthusiasm. The precise scope and value of the quaternion method are questions on which opinions have greatly differed, and the number of mathematicians otherwise eminent who could be reckoned as fully concurring in Prof. Tait's views on these points is probably very limited. In this country there has been a certain natural diffidence, and perhaps a little want of courage, which have hindered the free expression of opinion; but on the continent the assertion has been made again and again that the subject has in some respects been unfortunate in its expositors, and that the elements of undoubted value in the theory have been unduly discredited by the somewhat excessive claims made on its behalf. It is possible to sympathise